CNI User Meeting

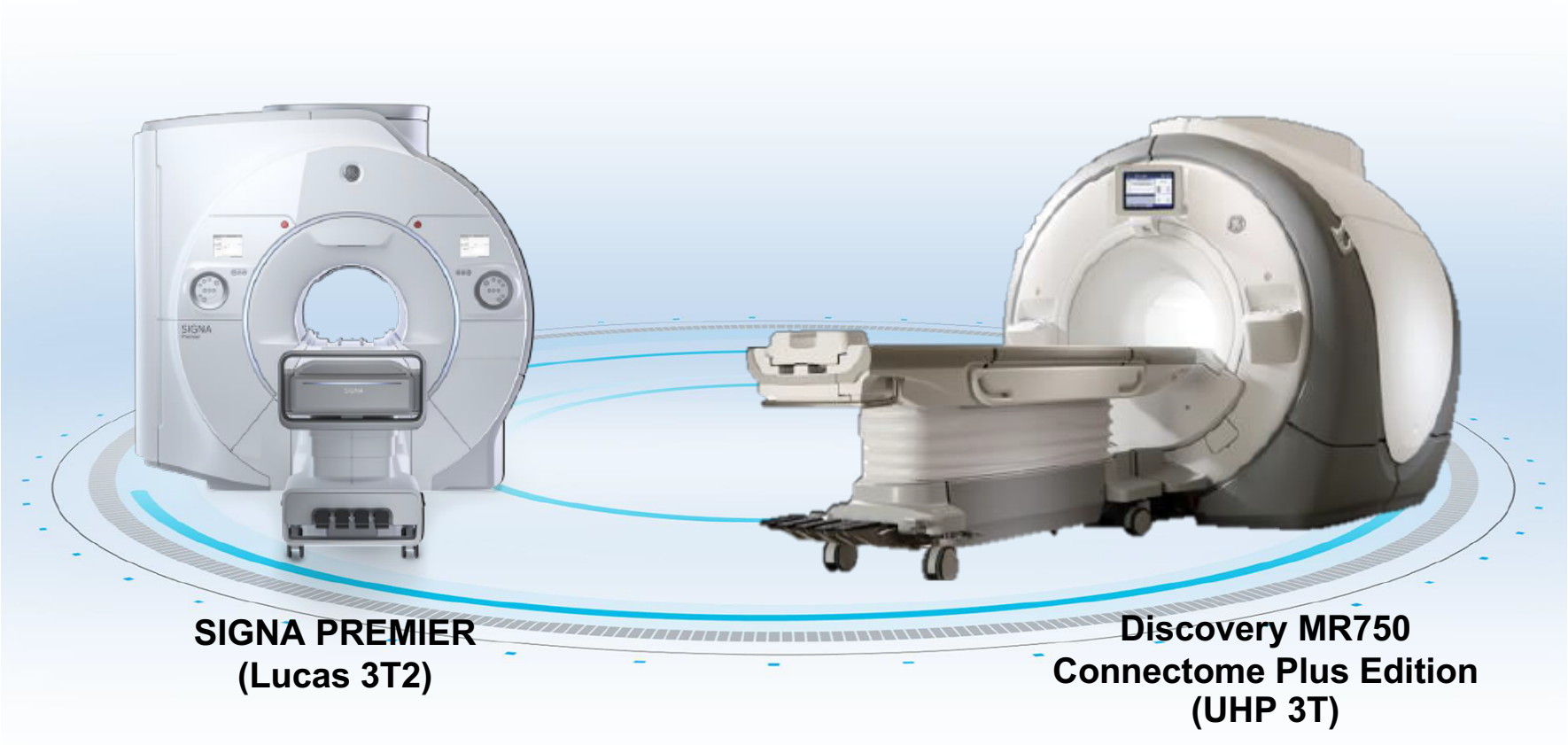
SEPTEMBER 6, 2019

CNI User Meeting Agenda

Sep. 6, 2019

- Upgrade System
- Upgrade Timeline
- System Comparison Plans and Preliminary Results
- CNI Support for Users at the Lucas Center
- Scheduling Accommodations
- User Discussion

Upgrade System Options



SIGNA PREMIER
(Lucas 3T2)

Discovery MR750
Connectome Plus Edition
(UHP 3T)

Upgrade System Options

Specification	Discovery MR750
Bore Diameter	60cm
Peak Gradient*	50 mT/m
Peak Slew**	200 mT/m/ms
Rx Channels	32
Comment	Current CNI System

*Peak gradient that is sustainable. Systems may have higher gradient strength, but only for limited duty cycle.
**Peak slew rate generally limited to 150 mT/m/ms for whole-body systems.

Upgrade System Options

Specification	Discovery MR750	SIGNA Premier
Bore Diameter	60cm	70cm
Peak Gradient*	50 mT/m	70 (80) mT/m
Peak Slew**	200 mT/m/ms	200 mT/m/ms
Rx Channels	32	140
Comment	Current CNI System	Main product roadmap

*Peak gradient that is sustainable. Systems may have higher gradient strength, but only for limited duty cycle.
**Peak slew rate generally limited to 150 mT/m/ms for whole-body systems.

Upgrade System Options

Specification	Discovery MR750	SIGNA Premier	Discovery MR750 UHP
Bore Diameter	60cm	70cm	60cm
Peak Gradient*	50 mT/m	70 (80) mT/m	100 (110) mT/m
Peak Slew**	200 mT/m/ms	200 mT/m/ms	250 mT/m/ms
Rx Channels	32	140	64
Comment	Current CNI System	Main product roadmap	Very stiff coil (7T)- minimal vibration

*Peak gradient that is sustainable. Systems may have higher gradient strength, but only for limited duty cycle.
**Peak slew rate generally limited to 150 mT/m/ms for whole-body systems.

UHP System

- UHP 3T system
  - New HRMB gradient coil developed for 7T system
  - Single 3T installation at Duke (Allen Song)
  - Lucas, UCSD, Michigan, Sunnybrook, others have expressed interest or plans to install
  - Same electronics as Premier, 60-cm bore
  - Improved gradients: 100 mT/m, 250 mT/m/ms
  - Gradient heating limits not an issue as they are with Premier

UHP System

- Receive arrays & shim coils
  - Additional 3rd-order shim coils -- 10 HOS coils in total
  - Will receive “NFL” 48-channel head coil and multipurpose surface AIR coils
  - Existing coils will continue to work
- New software features
  - Machine-learning assisted automatic prescription
  - New efficient quantitative MRI methods
  - High-resolution multishot diffusion methods

Upgrade Timeline

CNI Upgrade

Mon, 1/6/2020

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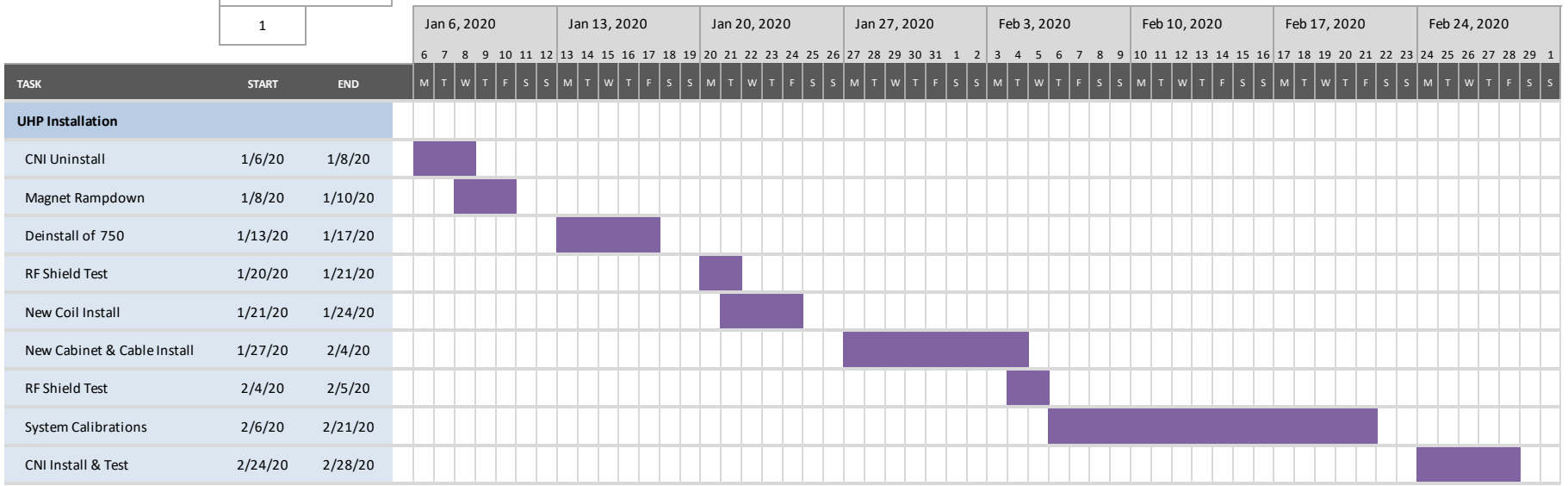


TASK	START	END
UHP Installation		
CNI Uninstall	1/6/20	1/8/20
Magnet Rampdown	1/8/20	1/10/20
Deinstall of 750	1/13/20	1/17/20
RF Shield Test	1/20/20	1/21/20
New Coil Install	1/21/20	1/24/20
New Cabinet & Cable Install	1/27/20	2/4/20
RF Shield Test	2/4/20	2/5/20
System Calibrations	2/6/20	2/21/20
CNI Install & Test	2/24/20	2/28/20

- Infrastructure (electrical & water) upgrades already begun
- Main installation to begin 1/6/2020 – complete 2/28/2020
- CNI facility largely unavailable during that period

System Evaluation

- Developing system comparison methods using CNI/Lucas systems as testbed
  - Receiver noise quantification
  - Temporal SNR maps on fBIRN phantom
  - FA comparison of travelling subject
  - TBD rsFMRI comparison of travelling subject
  - TBD task FMRI comparison of travelling subject
  - CNI staff will travel to Waukesha to test 3T UHP in October

Receiver Noise Quantification

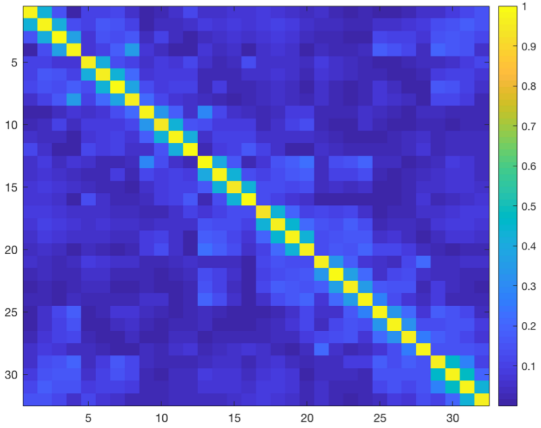
- Receive channel coupling degrades parallel imaging performance
- Noise test acquires data with no RF transmit (e.g. zero signal)
- Compare noise measurements between channels
- Ideal situation is zero correlation between different channels

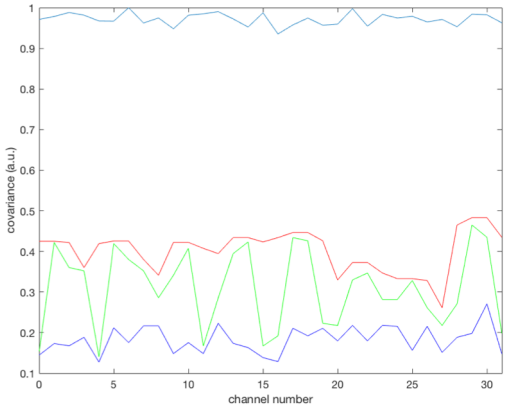
Receiver noise quantification

Noise Covariance Matrix

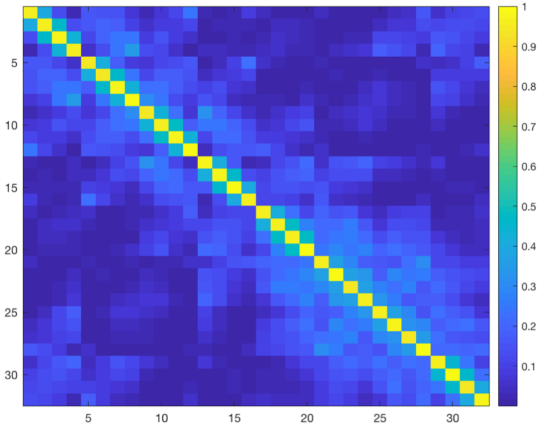
Largest 4 Components

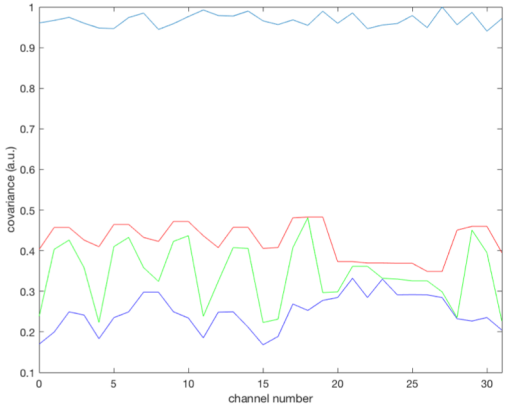
CNI Nova 32ch





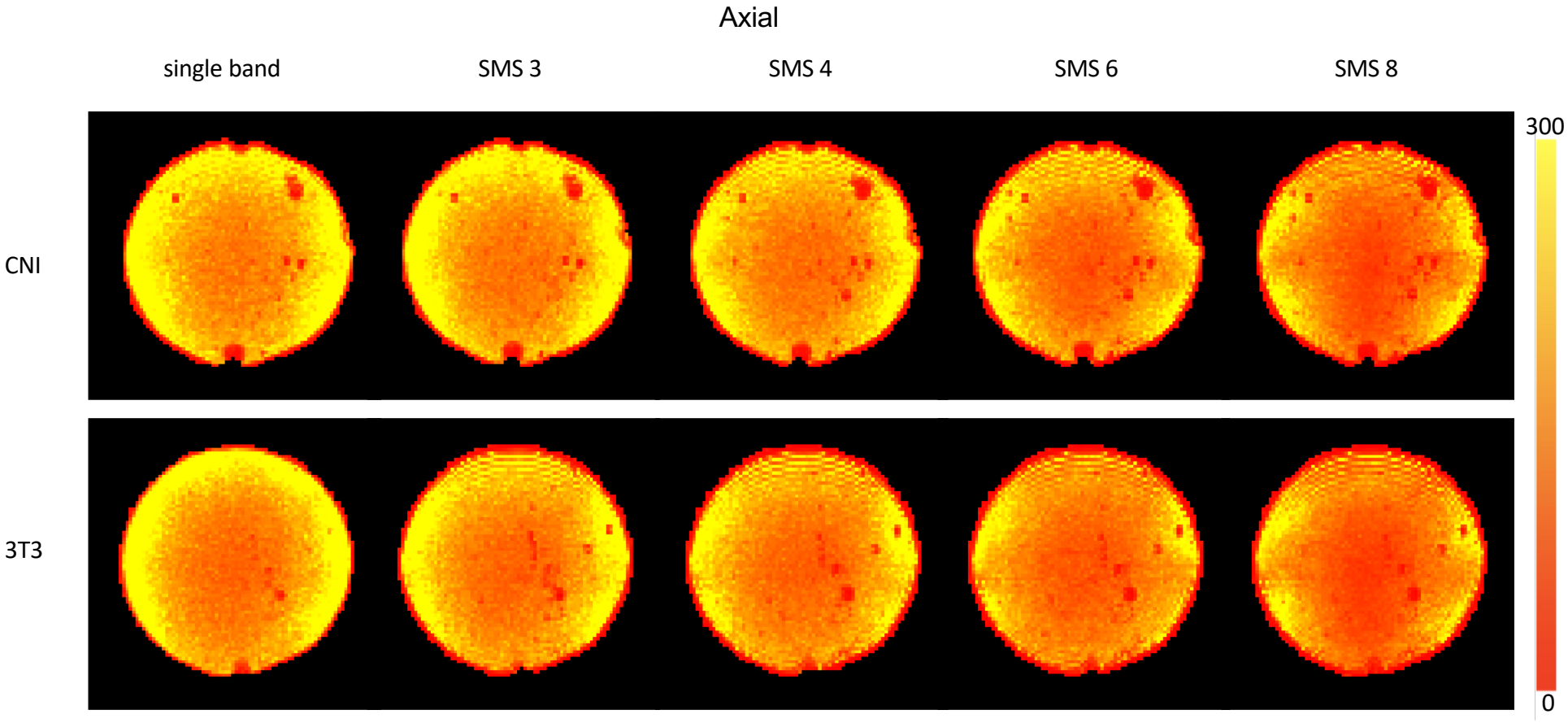
3T3 Nova 32ch





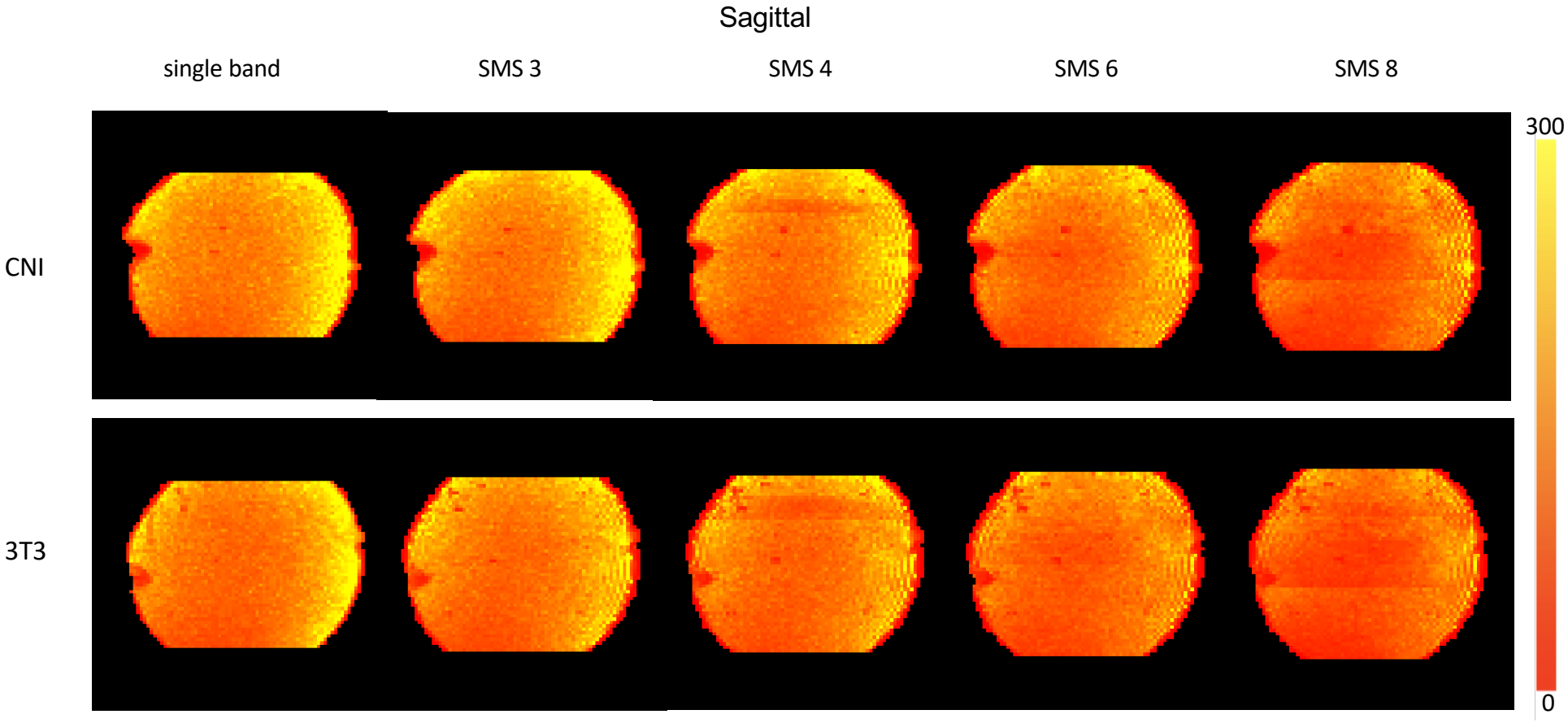
- Absolute noise levels are similar (not shown in the figure)
- Slightly higher covariance between channels in 3T3 Nova coil (note the 4th trace)

SMS EPI tSNR comparison



Axial Rx, Axial slice, 2.5mm iso, 15s/30ms TR/TE, 50 reps

SMS EPI tSNR comparison



Axial Rx, Sagittal slice, 2.5mm iso, 15s/30ms TR/TE, 50 reps

Support for Users at Lucas

- User access to Lucas Center
  - Unfortunately no shortcuts for CNI users
  - See http://med.stanford.edu/lucasmri/new-users.html
- IRB modification to include Lucas Center
  - A new IRB is not required – a previous IRB may be modified to include the Lucas Center in the list of resources
  - Note that as animals are studied at Lucas, additional language is required to describe safety procedures and is available on Lucas website
- SMS sequences are available on 3T3, and working on adding SMS reconstruction gear to lucascenter.Flywheel.io
- CNI can help in transferring protocols
- CNI setting up mechanism for automatic data transfer to cni.Flywheel.io

Scheduling Accommodations

- Special exceptions for booking outside the 8-week window is always possible by emailing Laima
- Longitudinal studies with strict time requirements on followup scans may want to book ahead or take advantage of the ”CNI Short Term Reserve Time”
- Labs will be allowed to book up to 4 hours of additional protocol development time to familiarize themselves with the new system

Help Maintain a Productive Environment

- Please stay on time
- Please return all supplies & equipment as necessary so they are ready for the next user
- We all enjoy a nice facility – please keep it looking that way by cleaning up
- Please help us to ensure good data quality
  - Please review your data in a timely fashion
  - Regular QA scans cannot capture all system problems / errors
  - Let us know of any problems as soon as possible

User Discussion

Questions? / Discussion